

REMARKS

Claims 1, 6, 7 and 9-12 are pending in the present application.

Claims 1, 6 and 9-12 were rejected under 35 USC §103(a) as being unpatentable over Japanese patent publication JP 10121913 (Toshiaki) in view of U.S. 4,015,436 (Seki) further in view of Reissue U.S. 33 408 to Khan et al. (Khan). Claim 7 was rejected under 35 USC §103(a) as being unpatentable over Toshiaki in view of Seki further in view of Khan and U.S. 3,889,485 (Swearingen). Applicants respectfully traverse the rejections above.

By this amendment, claim 1 has been amended with respect to "the at least one cooling means." No new subject matter is requested to be entered into the specification by the present amendment.

The Office Action at page 2, paragraph no. 3, contends that one of ordinary skill in the art would be guided to combine Toshiaki, Seki and Khan to arrive at the invention of independent claim 1. In view of the amendment to claim 1 and the remarks below, the undersigned respectfully disagrees with such position taken in the Office Action.

The invention of amended independent claim 1 is directed to reducing the size and power consumption of plural stage liquefied natural gas boil-off compressors. Such compressors may typically be required to compress boiled-off natural gas from a pressure of approximately 1 bar to a pressure of approximately 40 bars. With conventional water cooling between compression stages so as to remove heat of compression and a pressure ratio on the order of 2:1 across each stage, six separate stages are typically required to achieve the necessary natural gas pressure. In contrast, however, the compressor called for

in amended independent claim 1 can achieve a pressure ratio of 2.6:1 across each stage of a plurality of stages and can thus achieve the same pressure employing a lesser number, in this example, 4 compression stages (Spec. [0029]).

The Office Action contends that even though Toshiaki discloses a valve 34 installed at the discharge side 32 of a compressor 24, there is no teaching of: (i) the use of a similar valve between the compression stages, (ii) cryogenic cooling having direct cooling chamber means, and (iii) a liquid separator in communication with an outlet of the cryogenic cooling means.

Seki is directed to the operation of a single stage rotary blower which compresses boiled-off liquefied gas. A blower is a device for producing a current of air or gas. It is respectfully submitted that a person of ordinary skill in the art seeking to solve the problem of reducing the number of stages and power consumption of a plural stage liquefied natural gas compressor would not therefore seek out or be guided by Seki. Even if, for the sake of argument, the disclosure of Seki was sought and combined with that of Toshiaki, said combination would teach away from the subject matter of amended independent claim 1. That is, because Seki employs cooling in order to keep the discharge pressure of the blower constant, such teaching would not influence a person skilled in the art to use cryogenic cooling in order to increase the pressure ratio across a compression stage.

In addition, there would also be no reason for one of ordinary skill in the art to combine the disclosure of Toshiaki with that of Seki because Seki relates to a single stage rotary blower, whereas Toshiaki relates to a multi-stage reciprocating compressor. In other words, the two references relate to entirely different types of apparatus and further, neither reference contains any

disclosure pertaining to temperature control of interstage cooling, as called for in amended independent claim 1.

The disclosure of Khan if combined with that of Toshiaki and Seki would still not arrive at the subject matter of amended independent claim 1, nor, it respectfully is submitted, would one of ordinary skill in the art be guided to add the disclosure of Khan to that of Toshiaki and Seki.

Initially, it is noted that the characterization of Khan in the Office Action at page 3 is inaccurate. That is, Khan does not teach "an outlet of a direct cooling means (74) communicates with a vessel (100) adapted to disengage particles of liquid from the natural gas," as set forth in the Office Action. Referring to Figure 2 (and Figure 3 as well) of Khan, the outlet of heat exchanger column 74 is connected to a line 76 in communication with the blower 78 for moving the discharge from the column 74 into the line 36. The "direct cooling means (74)" outlet does not communicate with the "vessel (100)" as alleged in the Office Action. In addition, the vessel 100, which is a separator, has an outlet 102 which does not communicate (according to Figure 2 and Figure 3) with the "compressant stage 86". The outlet 102, which is a line, contains gaseous propane and heavier hydrocarbon components which enter a lower portion of the heat exchanger column 74 (Col. 4, Ins. 21-24). In addition, an outlet 31 of the separator 100 is in communication with a line 34 which ultimately ends up being fed into the deethanizer 44. Therefore, the outlet 102 for natural gas does not communicate with the compressor stage 86, as alleged in the Office Action.

It respectfully is submitted that the characterization of Khan is inaccurate and accordingly, could therefore not be combined with the disclosures of Toshiaki and Seki to arrive at the subject matter of amended independent claim 1.

Therefore, it respectfully is submitted that the use of Khan to support a §103(a) rejection of amended independent claim 1 is inappropriate and such rejection should be withdrawn.

It respectfully is submitted that amended independent claim 1 is not obvious in view of the combination of Toshiaki, Seki and Khan. Claims 6, 7 and 9-12 should also be considered nonobvious, in view of their dependence upon amended independent claim 1. If an independent claim is nonobvious under 35 U.S.C. §103, than any claim depending therefrom is nonobvious. (MPEP §2143.03).

The undersigned has addressed the instant rejections with respect to the independent claim in particular, and has distinguished the applied references with respect to said claim as discussed above. It is therefore deemed unnecessary to address specific allegations of the Office Action regarding each dependent claim. The undersigned therefore traverses these allegations, and does not concur with the same either explicitly or implicitly by not refuting each individually.

All issues raised in the Office Action are believed to have been addressed. In view of the foregoing amendments and remarks, favorable action on the merits, including entry of all amendments and allowance of all claims pending, respectfully is requested.

The Examiner is invited to telephone the undersigned to propose any further amendment(s) to advance prosecution of the present application to allowance.

Respectfully submitted,

Correspondence Information
Customer Number: 20411
Tel: 908-771-6167
Fax: 908-771-6159

/Joshua L. Cohen/
Joshua L. Cohen
Registration No. 34,307
Attorney for Applicant(s)
Date: September 7, 2011